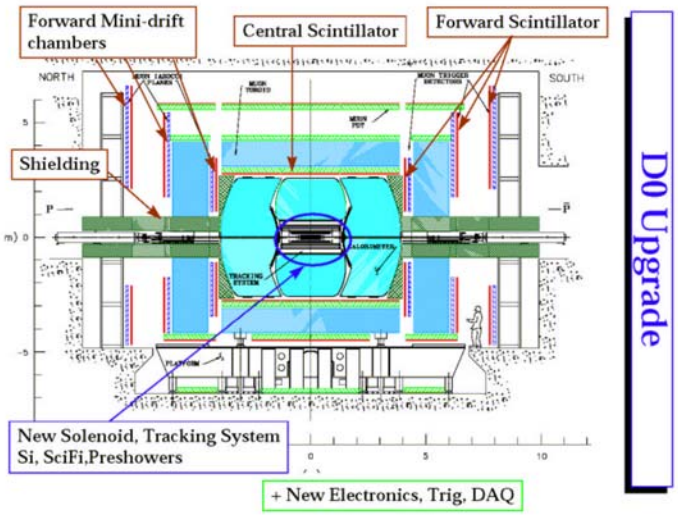
Status and Physics Program

- Status & Physics Program
- Upgrade & Shutdown Status G. Ginther
- Operations/Visitor Budgets L. Stutte
- Computing and Budget G. Davies
- D0 Resources & MoUs T. Wyatt



Institutions:

92 Total

39 US, 53 non-US

Collaborators

~ 671 Total

~ 50% from non-US institutions

~ 100 post-docs

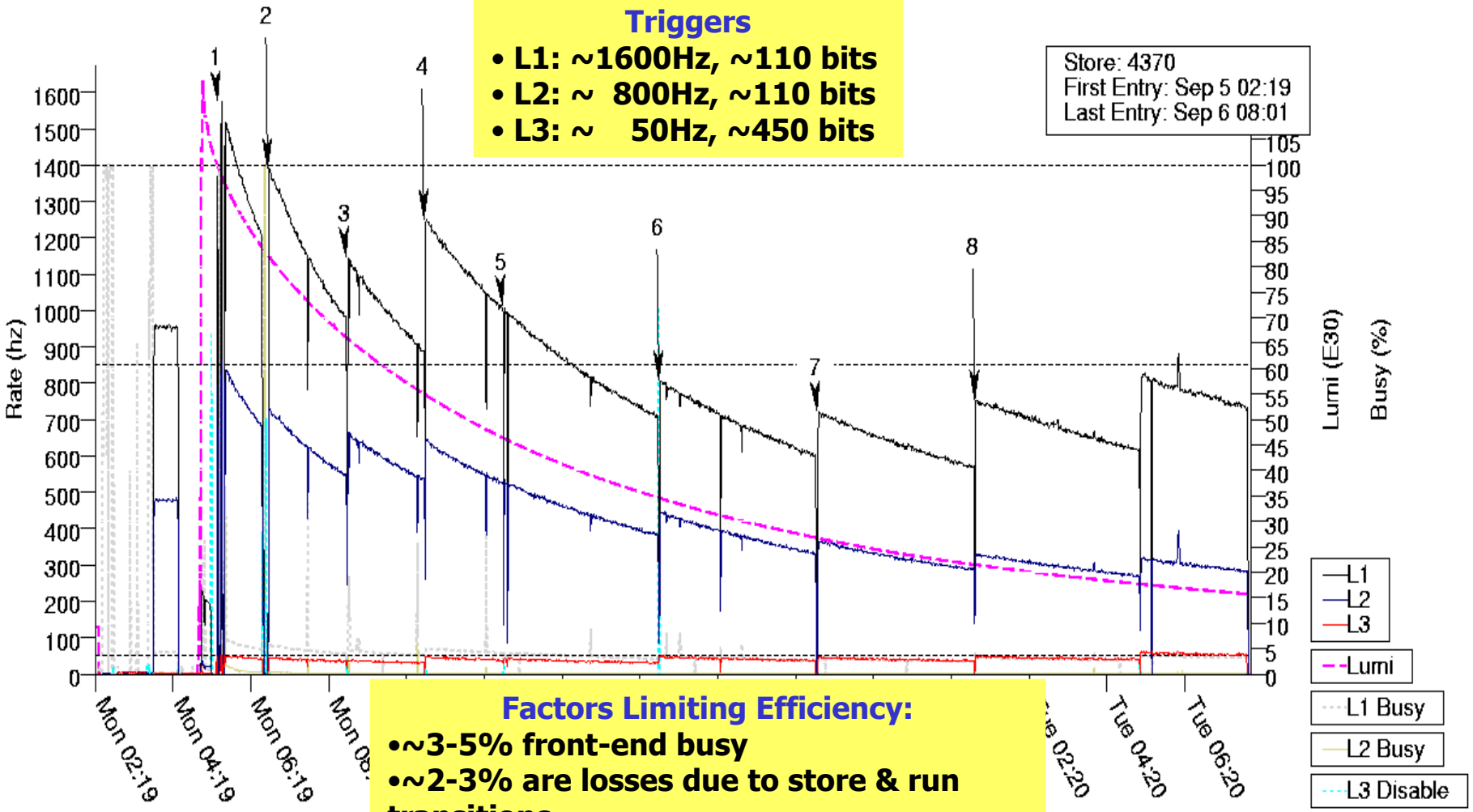
~ 140 graduate students

Overview of Today's Status Talks

- Ran efficiently at the highest luminosities
- Run IIa completed with 1.2fb^{-1} to tape (reading out the full detector)
- Continuing 0.4 fb^{-1} analysis/publications
- 1.5B event data set fully analyzed (Gavin) and preliminary results presented
- Upgrade production complete and installation well underway (George)

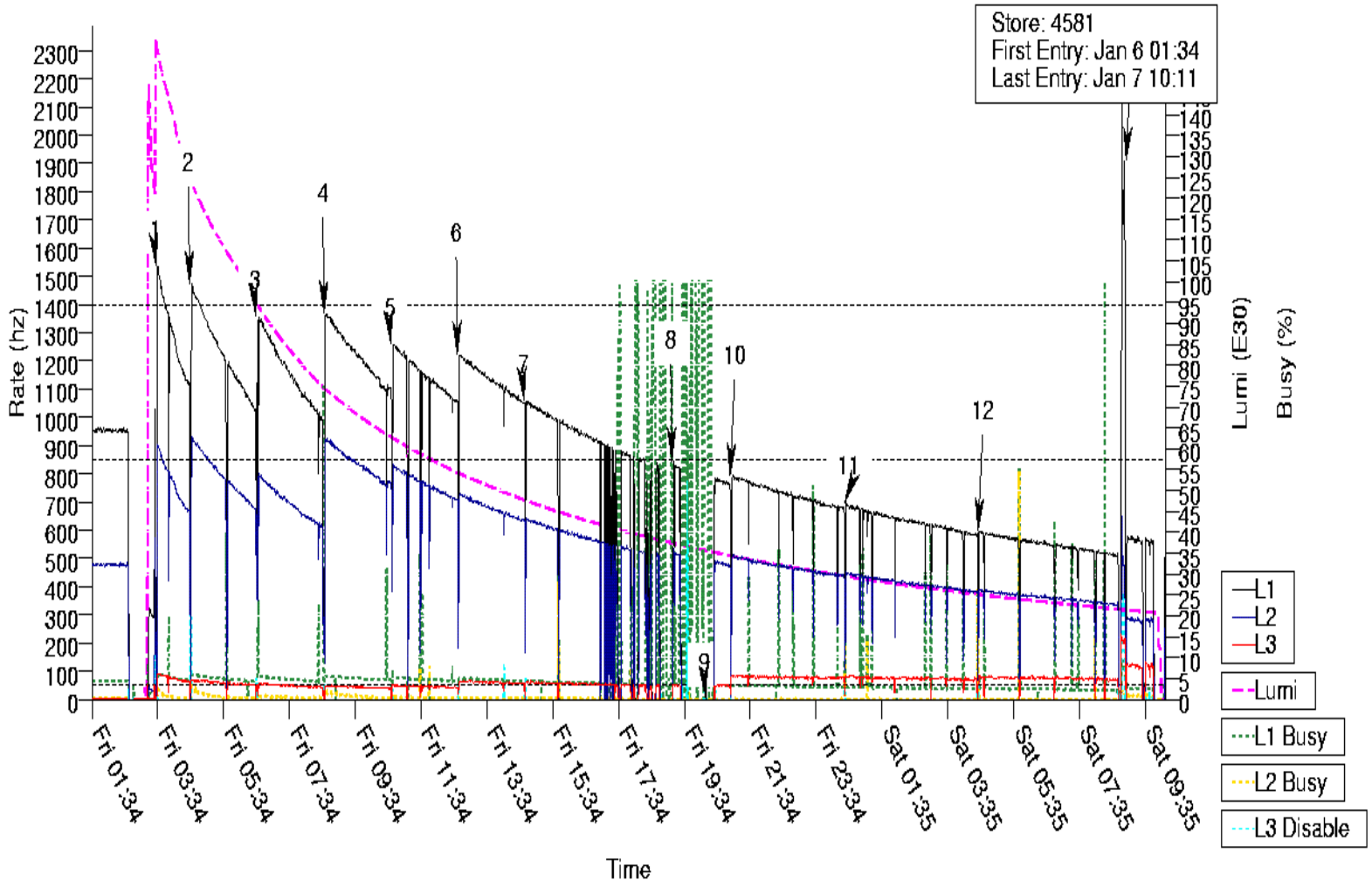
A Typical "100E30" Store

Triggers
- **L1: ~1600Hz, ~110 bits**
- **L2: ~ 800Hz, ~110 bits**
- **L3: ~ 50Hz, ~450 bits**



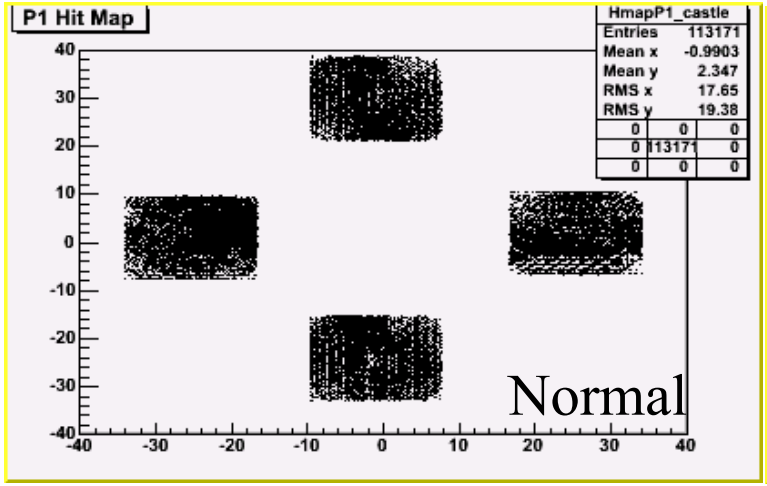
Factors Limiting Efficiency:
- **~3-5% front-end busy**
- **~2-3% are losses due to store & run transitions**
- **~5% "incidentals"**

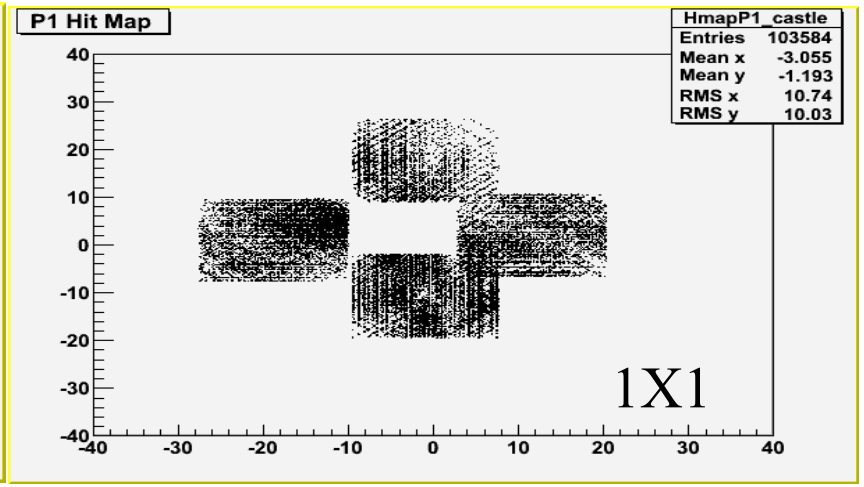
Record Store on 1/6/06 of 173E30!



Low Luminosity Running

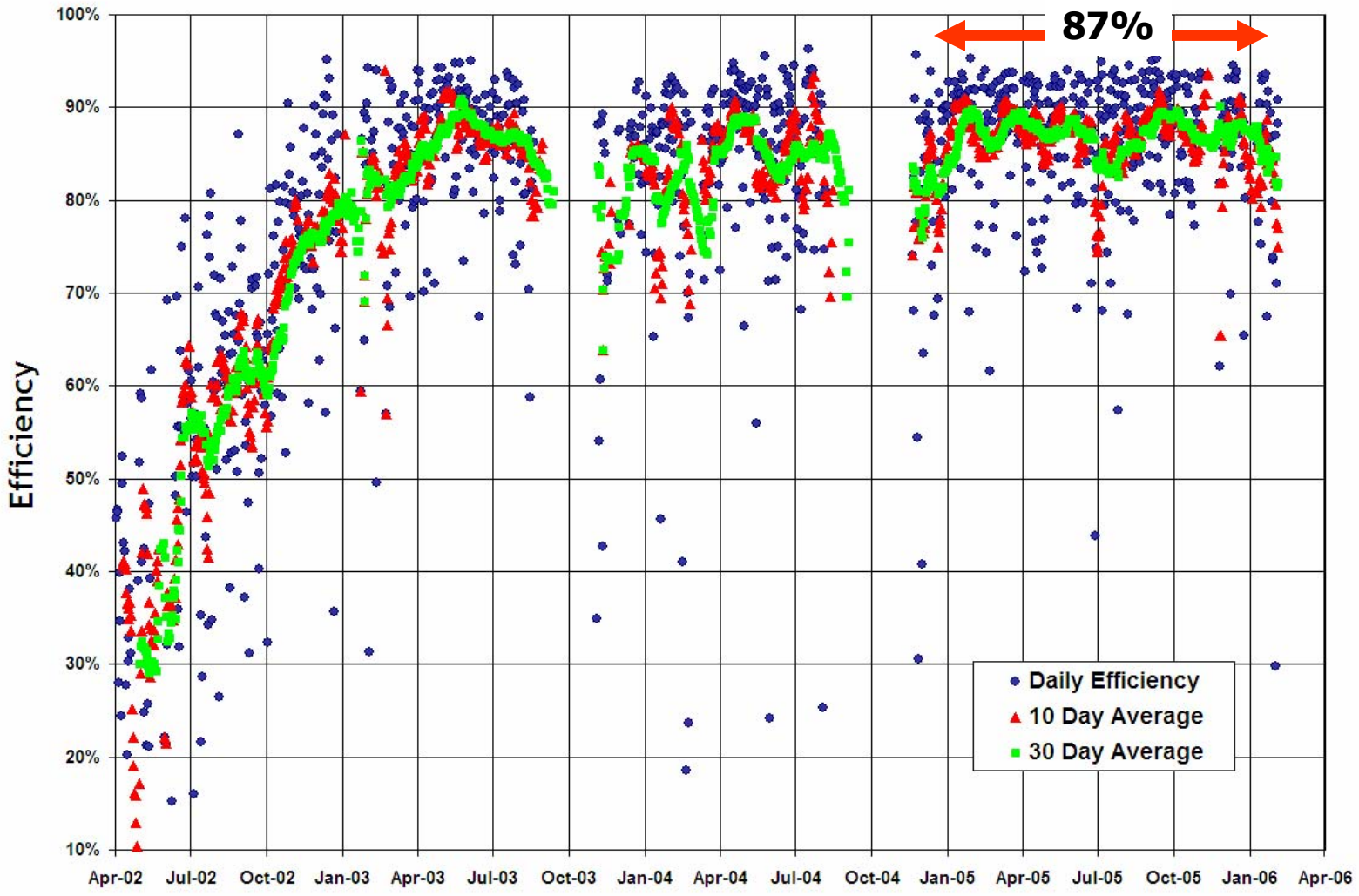
- The Tevatron provided two low luminosity stores (on the first try):
  - a 36X36, 28 cm beta*, 1E30 store.
  - a 1X1, 1.6 m beta* store.
- On the 1X1 store, the FPD group was able to get much closer to the beam.
  - This has allowed us to take low-t elastic and diffractive scattering events.
  - Having four dataloggers allowed us to write events at 250 Hz.
- No scheduled operation of FPD in Run IIb





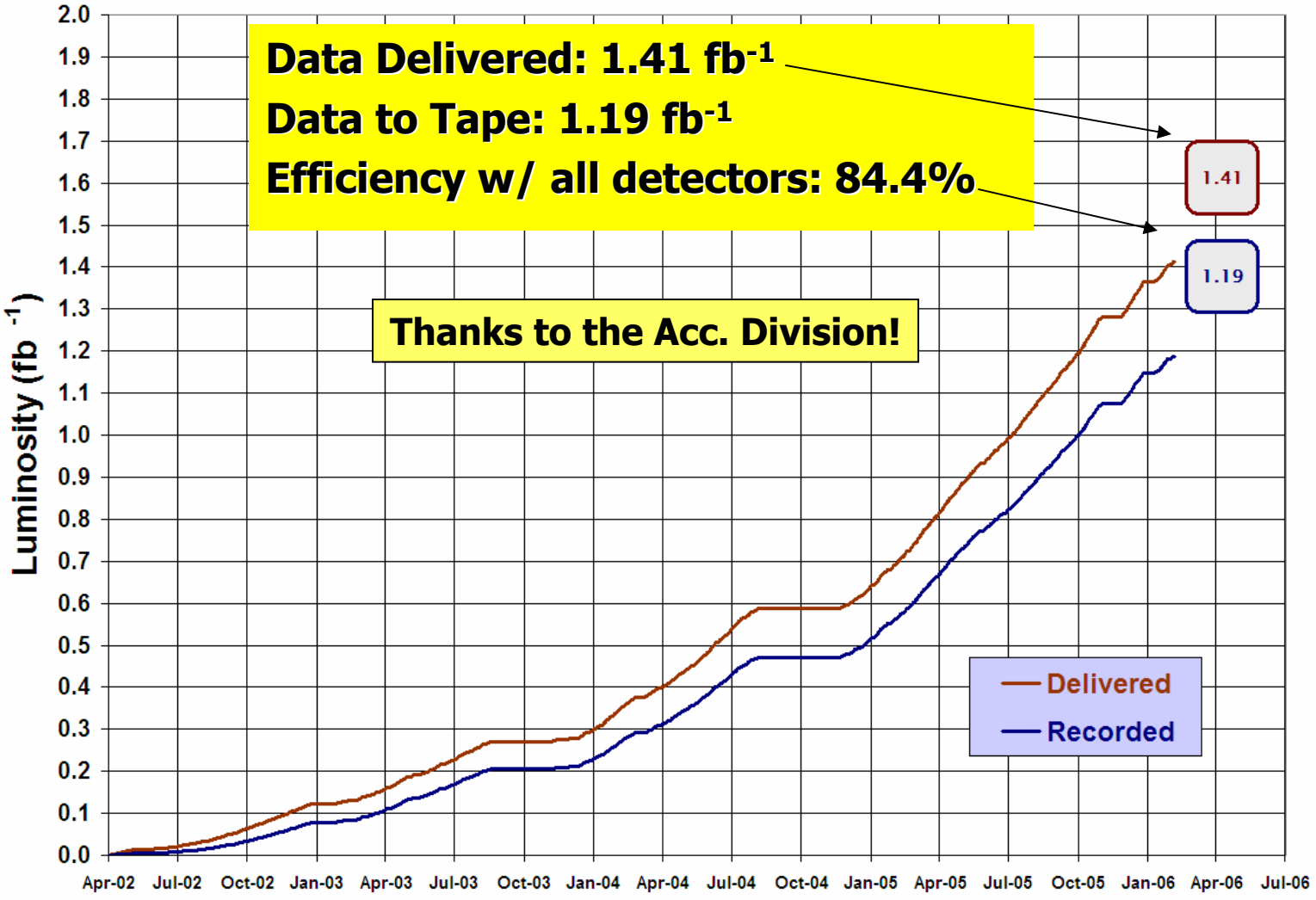
Daily Data Taking Efficiency

19 April 2002 - 22 February 2006



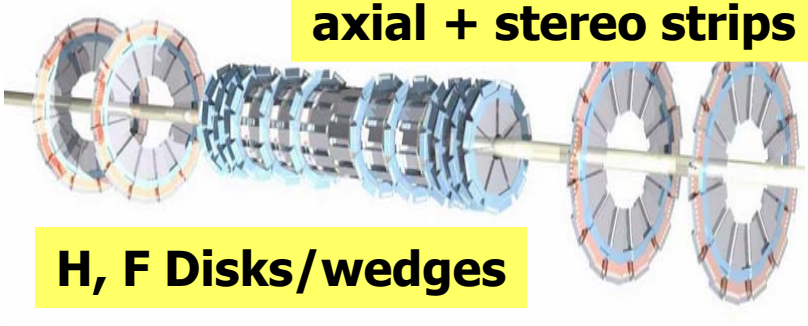
Run II Integrated Luminosity

19 April 2002 - 22 February 2006



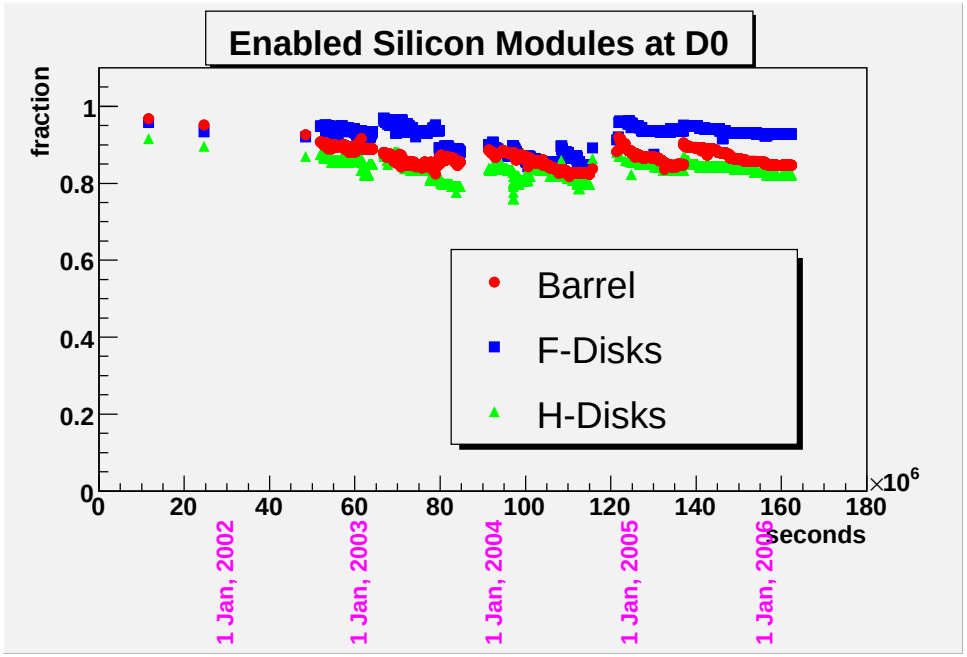
Silicon Microstrip Detector

4 barrel layers
axial + stereo strips



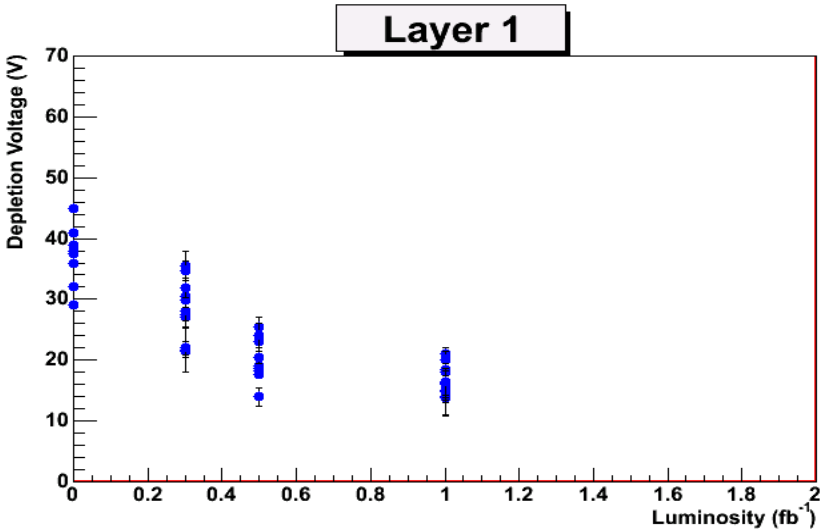
H, F Disks/wedges

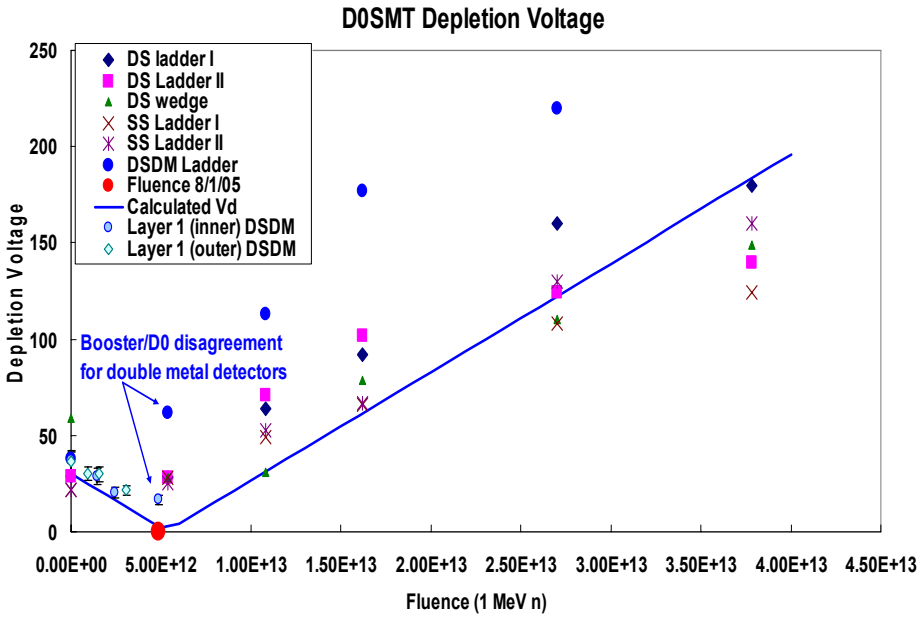
- **793k Channels**
- **S/Noise: > 10 all devices**
- **Cluster Efficiency: > 97%**
- **No fiducial loss**



Radiation Hardness

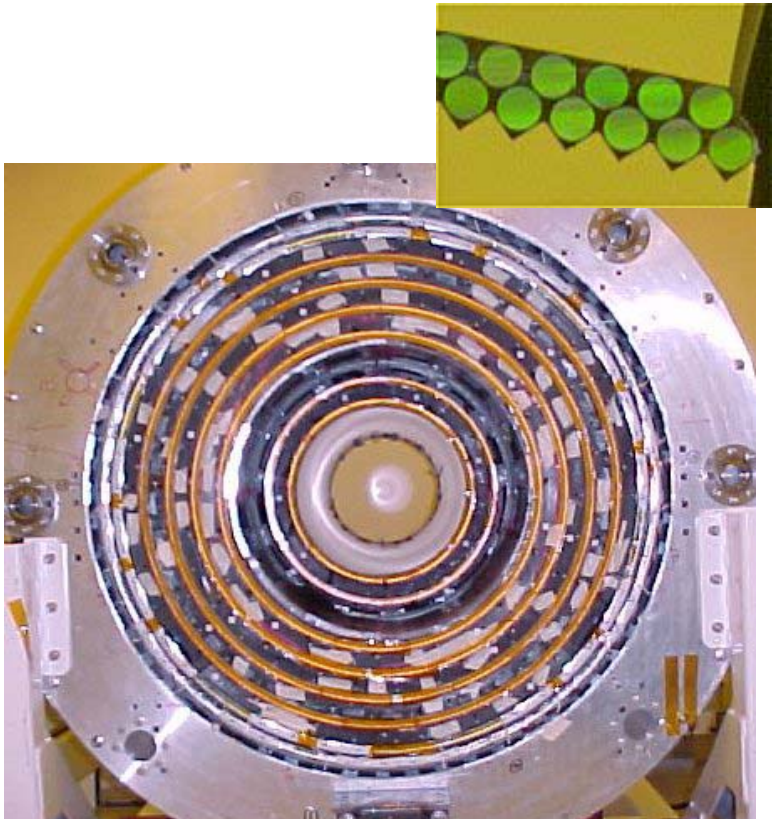
- **Studied**
  - In the booster
  - In situ with HV Scans of noise and efficiency
- **Depletion voltages**
  - Evolving as expected
  - For inner layer $V_{depletion} \sim V_{max} = 150V$ at 5—7 fb^{-1}





Central Fiber Tracker & Preshowers

- Eight axial & eight stereo layers
- VLPC readout at 8K
- Performing well
  - good light yield
  - layer $\varepsilon > 98\%$
- After November 2003 shutdown ~ 1% of VLPC channels not functional
  - was 0.1% before November
  - a one-time event
  - water contamination in cryostat?
- 2005 shutdown warmed up 1 (of 2) cryostats
  - pumped out 0.5l H_20
  - Upon cool down same loss rate BUT different channels
- Does not seriously degrade performance, but requires vigilance
- Not warming up!

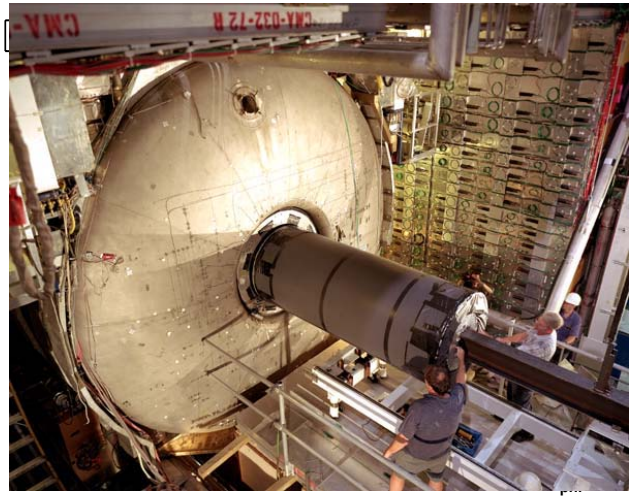


Solenoid

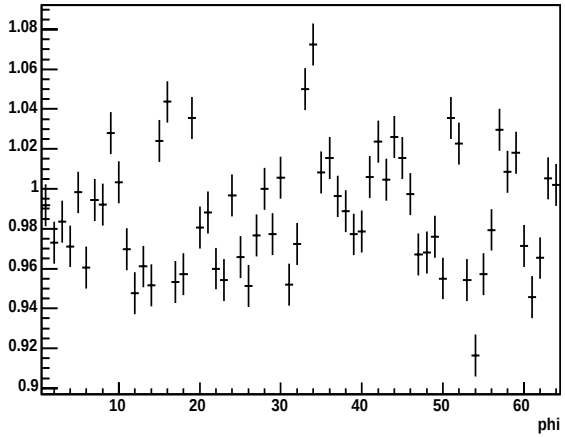
- Coming out of FY04 shutdown, while attempting to ramp to full current, the solenoid quenched.
- Clues :
  - An additional ~8W heat load was seen on the cooling system during operation
  - The south end of support cylinder shows an elevated temperature when powered
  - An excess in resistance is seen in the inner coil layer
  - Careful detailed review of history of temperature rise of south coil support when powered indicates that the degradation is strongly correlated with coil thermal cycles above 90K
- Diagnoses: Suspect degradation of inner layer conductor joint at south end of solenoid coil.
- Prescription:
  - Minimize future thermal disturbances
  - Limit power cycles
  - Upgraded cryogenics plant to provide additional operating margin
- Carefully monitored coil resistance and support temperature since beginning of FY05 run & show no further signs of degradation.
- Have run stably at 4550A (rather than 4750A) for ~ year

Calorimeter

- Liquid argon calorimeter with uranium absorber
  - Operating Smoothly
  - 99.9% of 55,000 channels operational
- Completed an in situ cell-by-cell calibration of EM and Had calorimeters, Z pole resolution improved from 3.35 GeV to 2.93 GeV
- Aggressive program to reduce noise continues, episodic but O(~%)



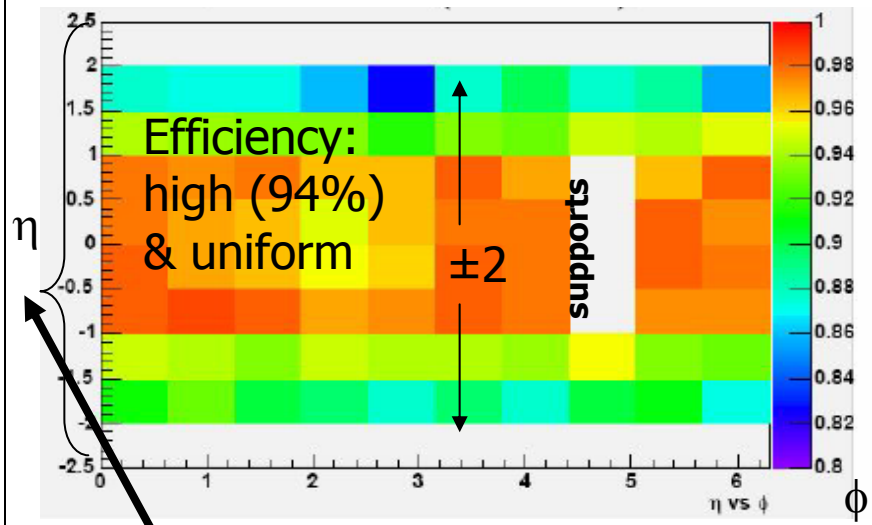
layer 3 Calibration Constants



Correction factors at η=0.5

Muon Systems

- **Three layers tracking & triggering**
- **Central**
  - **PDTs: 98.6% of 8k tubes active**
  - **Scintillator: 99.8% of 630 counters active**
- **Forward**
  - **Scintillator:**
    - **99.9% of 4608 counters active**
    - **Expect around 10% degredation (mainly in phototube) at 15 fb^{-1}**
  - **MDTs:**
    - **99.7% of 50k wires active**
    - **one plane disabled due to broken wire.**
- **Stable**
- **Highly Efficient**



Strength of DZero

Publications

(http://www-d0.fnal.gov/www_buffer/pub/Run2_publications.html)

2004

1) *Search for Doubly-charged Higgs Boson Pair Production in the Decay to mu+mu+mu-mu- in pbarp Collisions at sqrt(s)=1.96 TeV*
2) *Observation and Properties of the X(3872) Decaying to J/psi pi+pi- in pbarp Collisions at sqrt(s)=1.96 TeV*

2005

1) *Search for Supersymmetry with Gauge-Mediated Breaking in Diphoton Events at DZero*
2) *Measurement of Dijet Azimuthal Decorrelations at Central Rapidities in pbarp Collisions at sqrt(s)=1.96 TeV*
3) *Measurement of the B_s^0 Lifetime in the Exclusive Decay Channel B_s^0->J/psi phi*
4) *A Search for the Flavor-Changing Neutral Current Decay B_s^0->mu+ mu- in pbarp Collisions at sqrt(s)=1.96 TeV*
5) *Measurement of the Ratio of B+ and B0 Meson Lifetimes*
6) *Measurement of the Lambda-B Lifetime in the Decay Lambda-B -> J/psi Lambda With the D0 Detector*
7) *A Search for Wbb and WH Production in pbarp Collisions at sqrt(s)=1.96 TeV*
8) *Measurement of the WW Production Cross Section in pbarp Collisions at sqrt(s)=1.96 TeV*
9) *A Measurement of the Ratio of Inclusive Cross Sections pbarp->Zb/pbarp->Zj at sqrt(s)=1.96 TeV*
10) *A search for anomalous heavy-flavor quark production in association with W bosons*
11) *First measurement of sigma(ppbar->Z)xBr(Z->tau tau) at sqrt(s)=1.96 TeV*
12) *Search for first-generation scalar leptoquarks in ppbar collisions at sqrt(s)=1.96 TeV*
13) *Study of Zgamma events and limits on anomalous ZZgamma and Zgammagamma couplings in pbarp collisions at sqrt(s)=1.96 TeV*
14) *Measurement of inclusive differential cross sections for Upsilon(1S) production in ppbar collisions at sqrt(s)=1.96 TeV*
15) *Measurement of the p-barp -> Wgamma +X Cross section and Limits on Anomalous WWgamma Couplings at sqrt(s)=1.96 TeV*
16) *Search for Randall-Sundrum Gravitons in Dilepton and Diphoton Final States*
17) *Search for right-handed W bosons in top quark decay*

Accepted or Submitted

20) Production of WZ Events in p-barp Collisions at sqrt(s)=1.96 TeV and Limits on Anomalous WWZ Couplings
21) Search for neutral supersymmetric Higgs bosons in multijet events at sqrt(s)=1.96 TeV
22) Search for supersymmetry via associated production of charginos and neutralinos in final states with three leptons
23) Search for single top quark production in pbarp collisions at sqrt(s)=1.96 TeV
24) Measurement of the lifetime difference in the Bs system
25) Measurement of semileptonic branching fractions of B mesons to narrow D** states
26) Search for large extra spatial dimensions in dimuon production at DZero
27) Measurement of the ttbar cross section in pbarp collisions at sqrt(s)=1.96 TeV using kinematic characteristics of lepton plus jets events
28) Measurement of the ttbar cross section in pbarp collisions at sqrt(s)=1.96 TeV using lepton plus jets events with lifetime b-tagging
29) Measurement of the ttbar production cross section in pbarp collisions at sqrt(s)=1.96 TeV in dilepton final states

2006

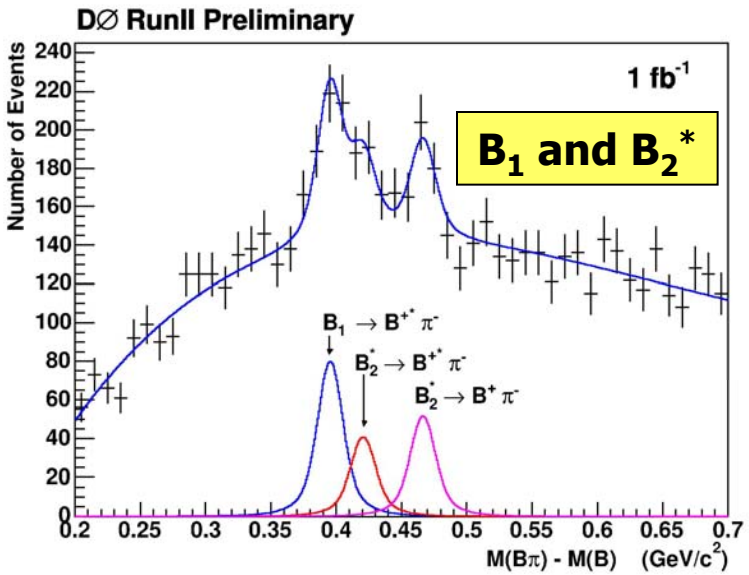
30) Search for the Higgs Boson in H->WW(*) Decays in ppbar Collisions at sqrt(S)=1.96 TeV
31) Search for Pair Production of Second Generation Scalar Leptoquarks in pbarp Collisions at sqrt(s) = 1.96 TeV
32) The Upgraded D0 Detector
33) Measurements of the isolated photon cross section in pbarp Collisions at sqrt(s) = 1.96 TeV
34) First Direct Two-Sided Bound on the Bs0 Oscillation Frequency $1fb^{-1}$
35) Measurement of B(t->bW)/B(t->qW) at sqrt(s) = 1.96 TeV
36) Search for the Rare Decay B0_s -> phi mu^+ mu- with the D0 Detector
37) Multivariate searches for single top quark production with the DZero detector
38) Search for Squarks and Gluinos in Events with Jets and Missing Transverse Energy in pbarp Collisions at sqrt(s)=1.96 TeV
39) Search for Excited Muons in pbarp Collisions at sqrt(s)=1.96 TeV

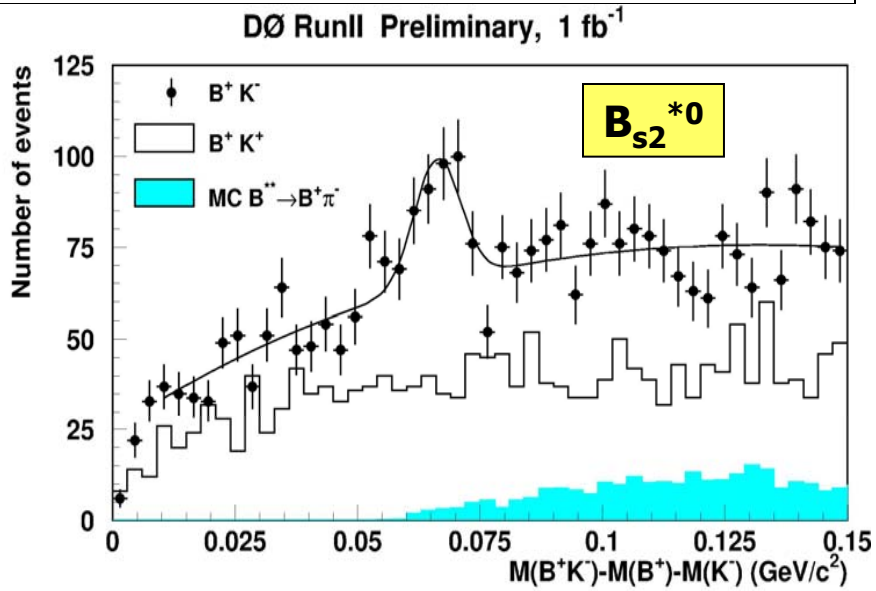
Preliminary Inverse Femtobarn Results!

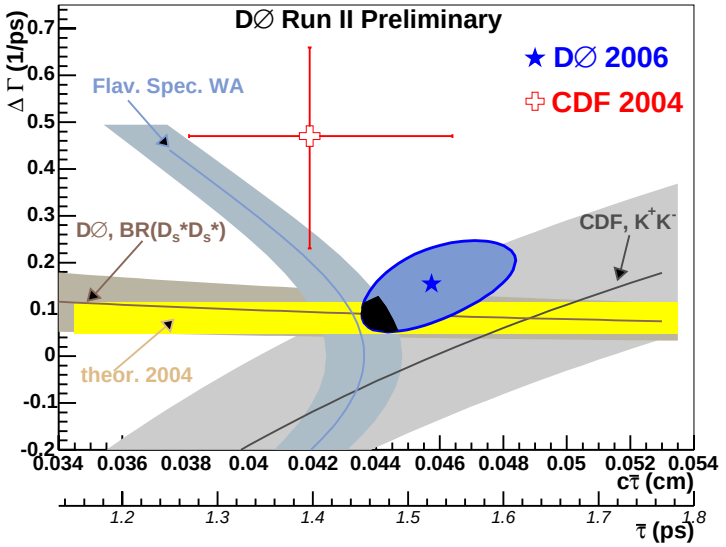
- First direct observation of the B^{*0}_{s2} meson
- First direct measurement of mass splitting between the excited B_1 and B^*_2 mesons
- World's best limit on CP violation in like-sign di-muon events
  - $\Re(\varepsilon_{B^0}) / [1-|\varepsilon_{B^0}|2] = -0.0011 \pm 0.0010 \pm 0.0007$
- World's best measurement of lifetime difference in B^0_s
  - $\Delta\Gamma = \Gamma_L - \Gamma_H = 0.15 \pm 0.10$ (stat) ± 0.04 (syst) ps^{-1}
- World's best measurement of the branching ratio $B^0_s \rightarrow D_s^{(*)} D_s^{(*)}$
  - $Br(B^0_s \rightarrow D_s^{(*)} D_s^{(*)}) = 0.071 \pm 0.32$ (stat) $+0.029 -0.025$ (syst)
- First measurement of the branching ratio for a B^0_s semileptonic decay to an orbitally excited D_s^{**} meson
  - $Br(B^0_s \rightarrow D_{s1}(2536)\mu\nu X) = [0.86 \pm 0.16$ (stat) ± 0.13 (syst) ± 0.09 (input BR)]%
- World's best limits on the FCNC charm decay
  - $Br(D^+ \rightarrow \pi^+\mu^+\mu^-) < 4.7 \times 10\text{-}6$ @ 90% CL
- A New Expected Upper Limit on the Rare Decay $B^0_s \rightarrow \mu\mu$
- Search for the Higgs Boson in H->WW*->ll' Decays with 950 pb-1
- Z+jets in the DØ Detector: A Comparison of Sherpa and Pythia
- Search for GMSB SUSY in Diphoton Events with Large Missing ET with the D0 Detector
- Inclusive Jets

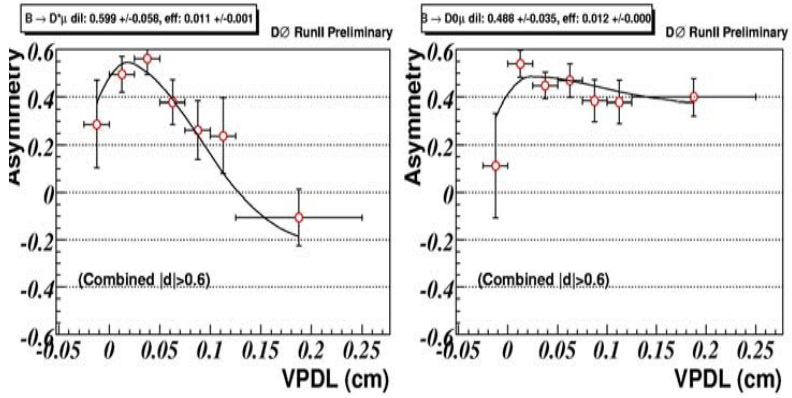
73 preliminary analyses in total

1 fb^{-1} B Physics





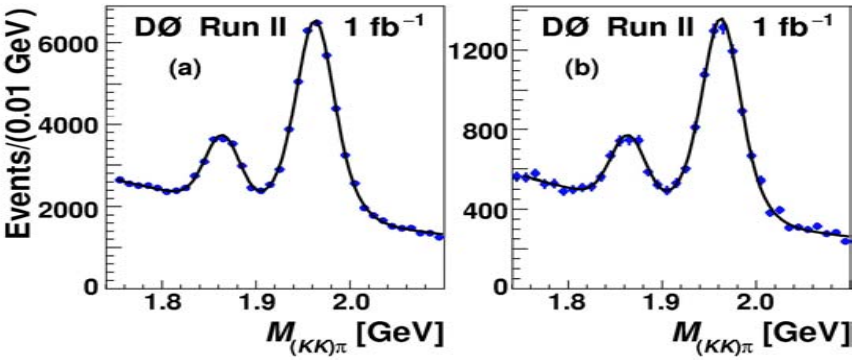


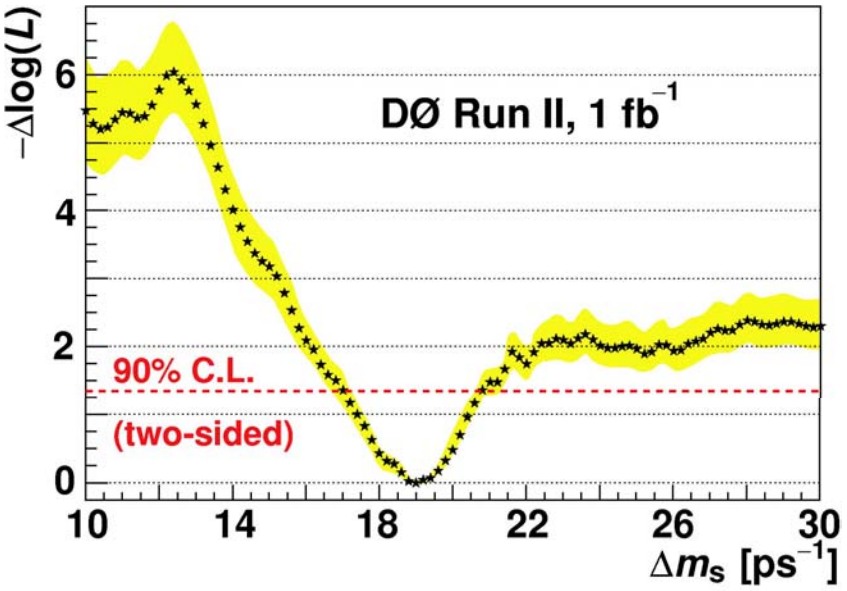


$\Delta m_d = 0.506 +/- 0.20$ ps^{-1}
HFAG=0.507+/-0.004ps^{-1}

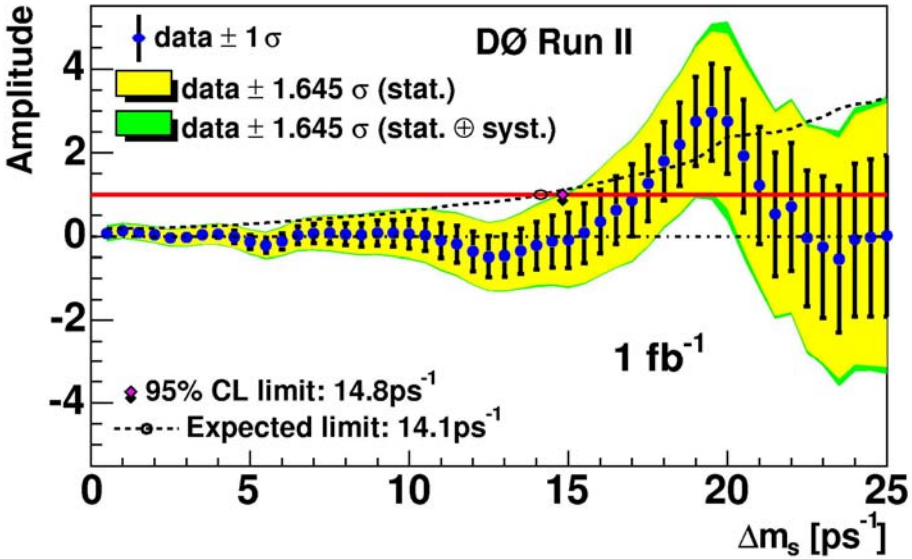
First Direct Two-Sided Bound on the B_s^0 Oscillation Frequency

$B_s \rightarrow \nu\mu Ds \rightarrow \nu\mu\pi KK$

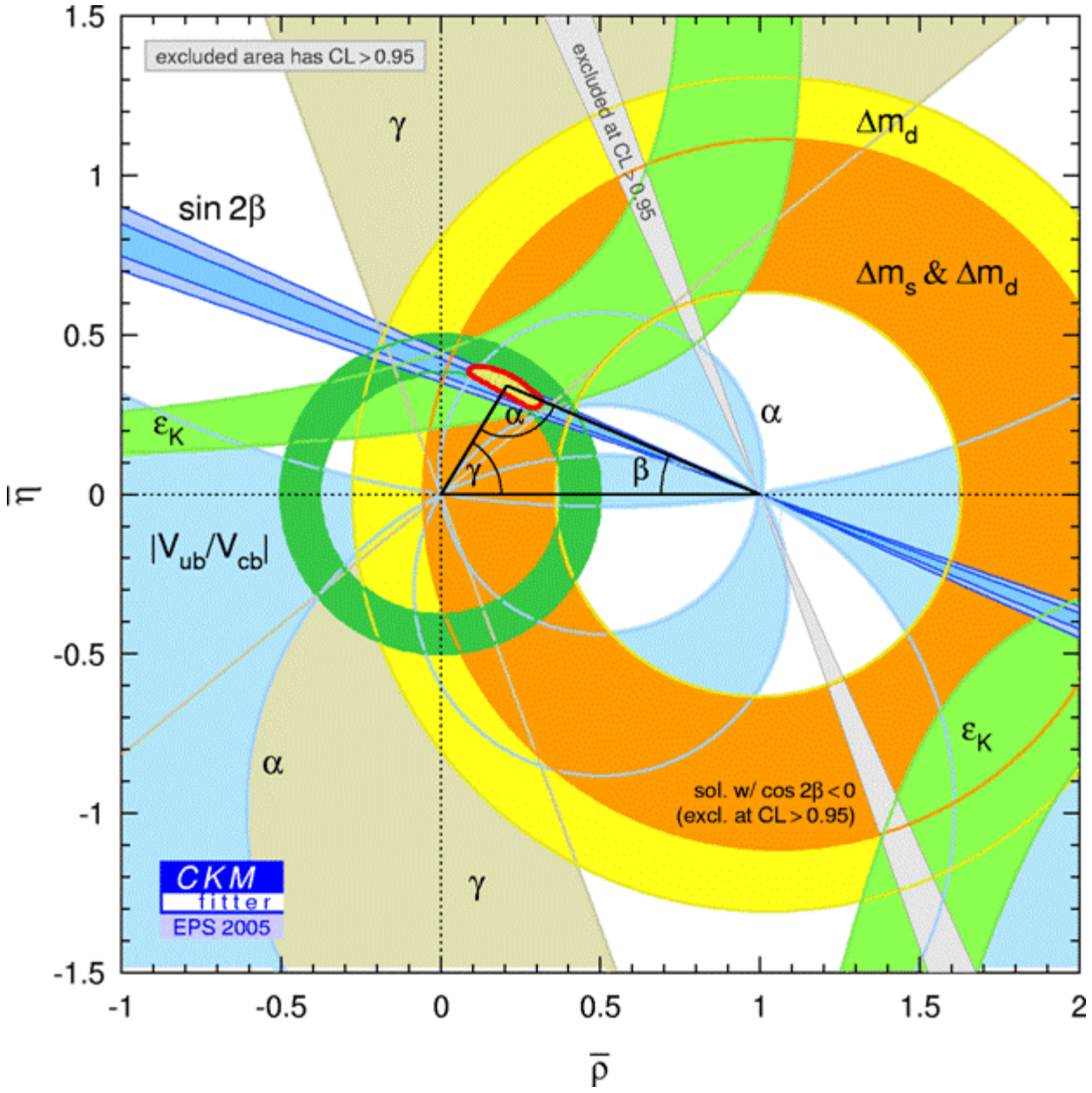


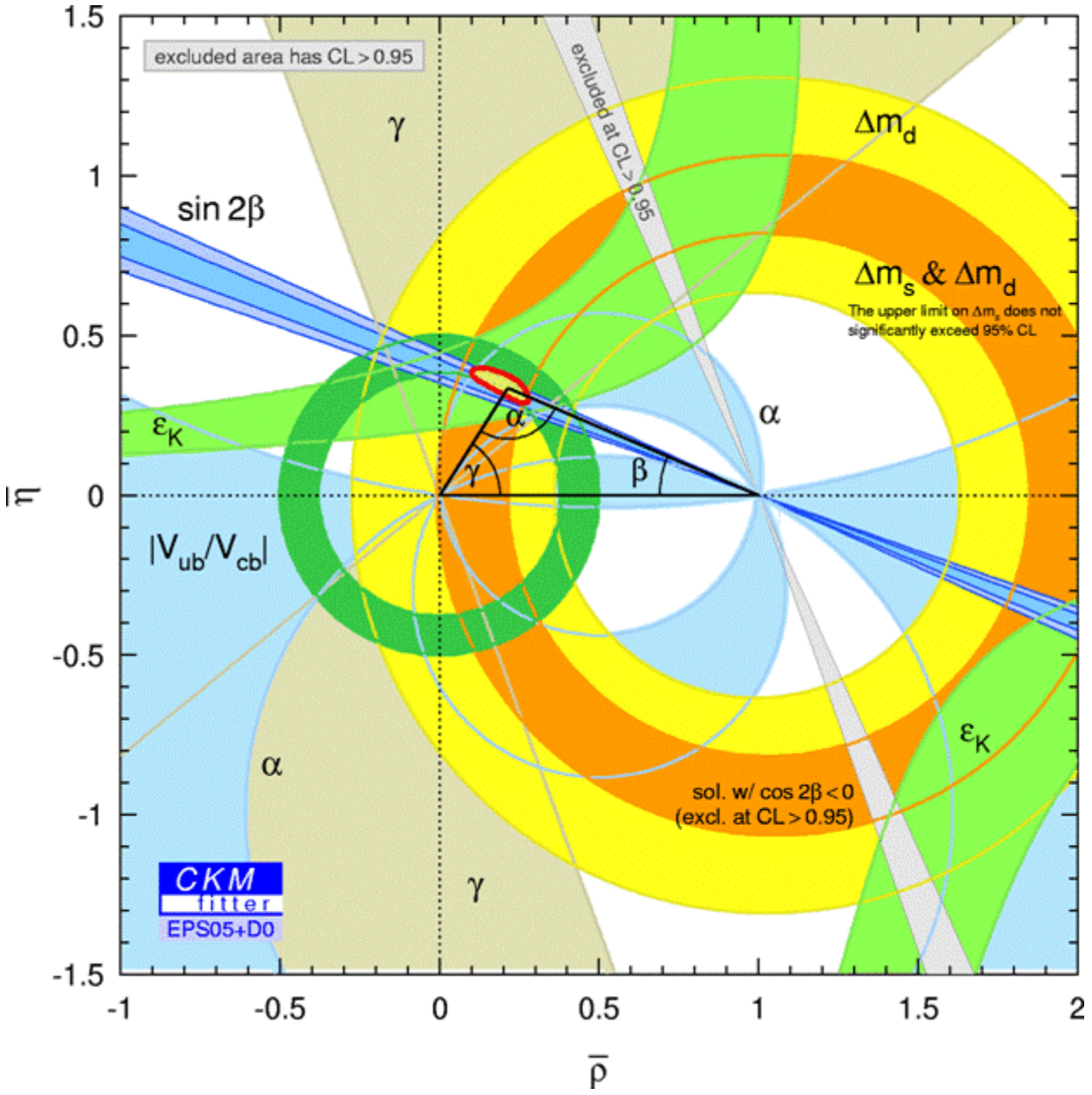


- **Submitted to PRL March 15, 2006**

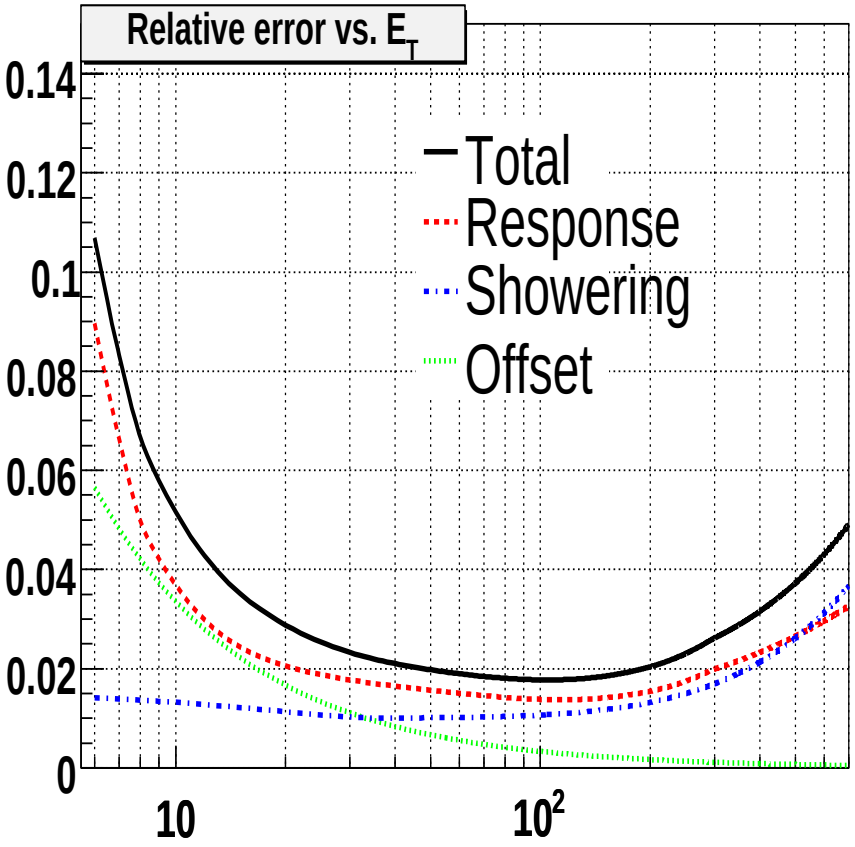


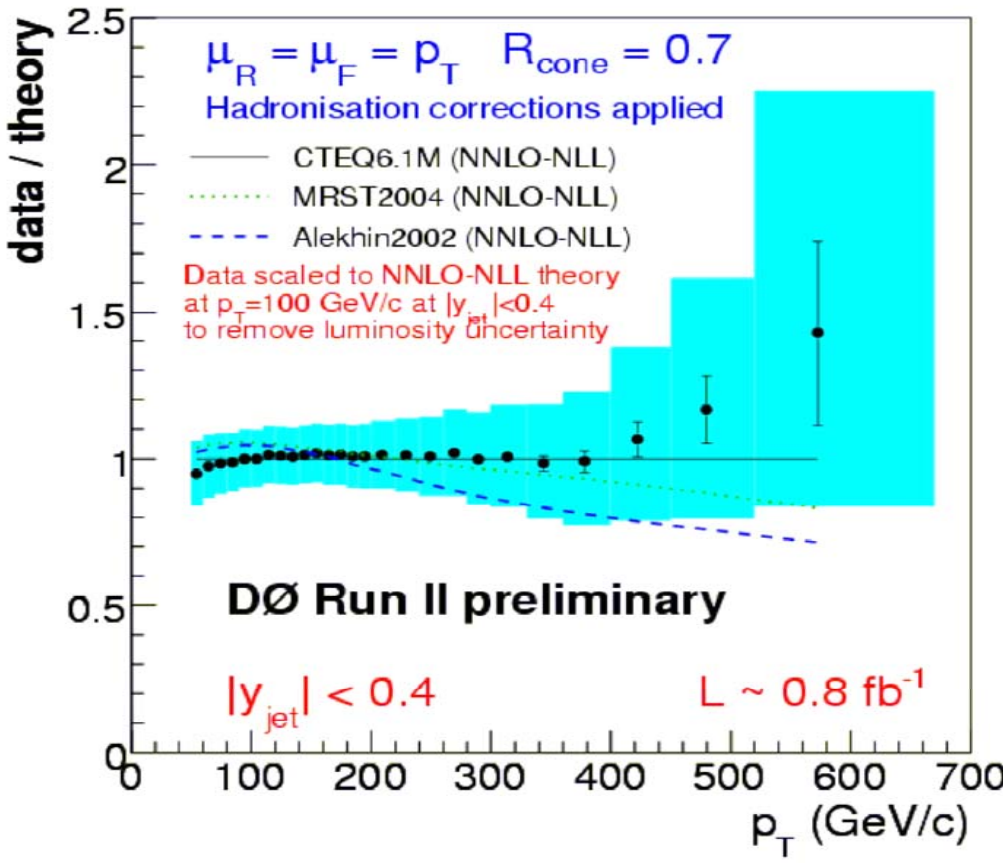
- **Most probable value 19 ps^{-1}**
- **$17 < m_s < 21$ ps^{-1} at the 90% C.L**


excluded area has CL > 0.95
excluded at CL > 0.95
γ
Δm_d
sin 2β
Δm_s & Δm_d
α
ε_K
α
γ
β
|V_ub/V_cb|
α
ε_K
sol. w/ cos 2β < 0
(excl. at CL > 0.95)
CKM
fitter
EPS 2005
γ
η̄
ρ̄
1.5
1
0.5
0
-0.5
-1
-1.5
-1
-0.5
0
0.5
1
1.5
2

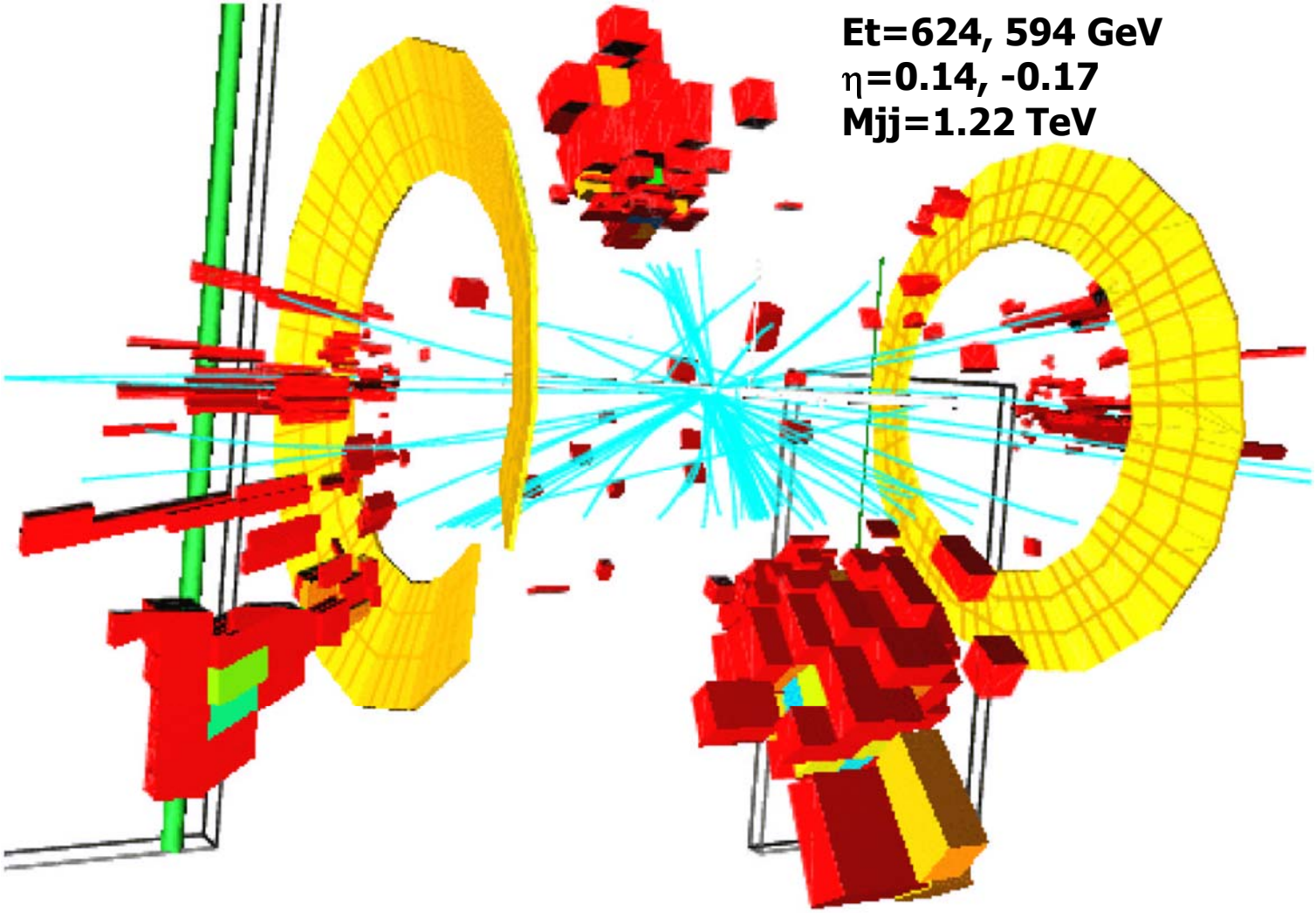

excluded area has CL > 0.95
excluded at CL > 0.95
γ
Δm_d
sin 2β
Δm_s & Δm_d
The upper limit on Δm_s does not significantly exceed 95% CL
α
ε_K
α
γ
β
|V_ub/V_cb|
ε_K
α
sol. w/ cos 2β < 0
(excl. at CL > 0.95)
γ
CKM fitter
EPS05+D0
1.5
1
0.5
0
-0.5
-1
-1.5
-1
-0.5
0
0.5
1
1.5
2
η̄
ρ̄

QCD and Jet Calibration

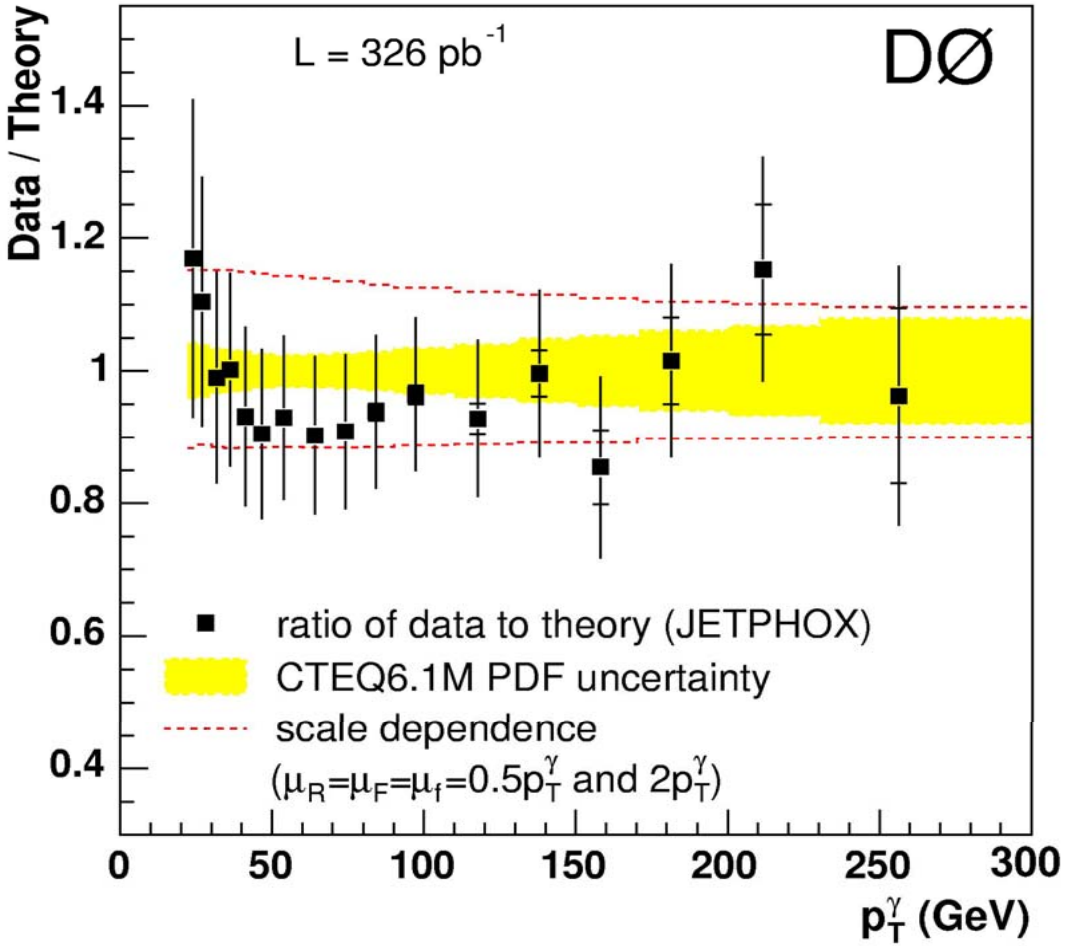




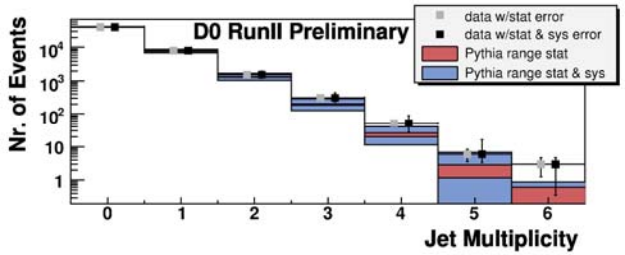
Just for Fun!

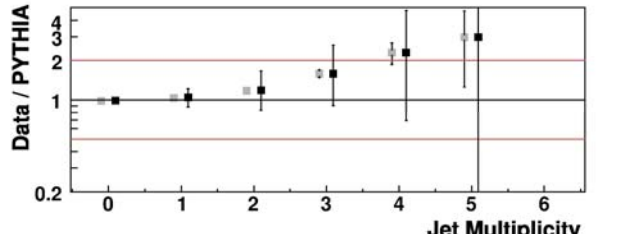


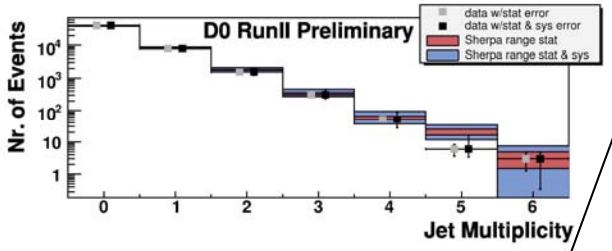
QCD: Direct Photon Production

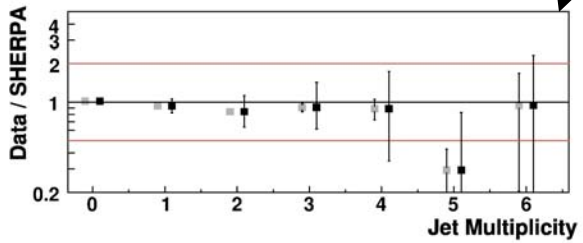


Electroweak



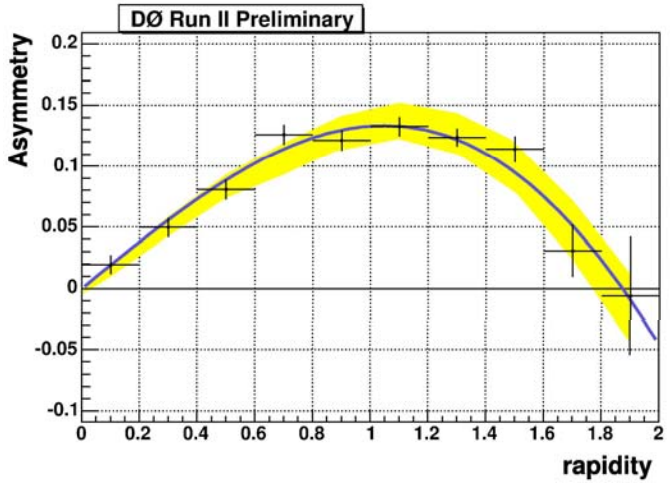






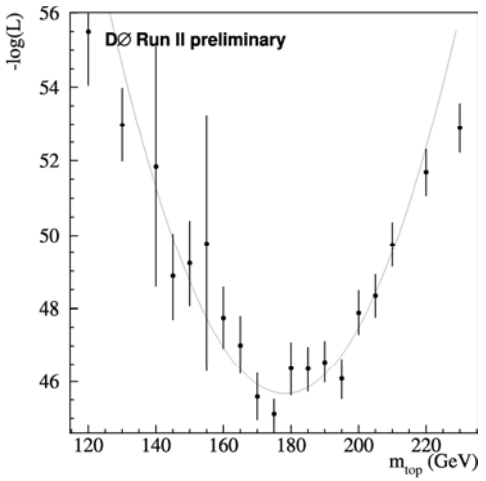
Z+jet multiplicity study
- **950 pb^{-1}**
- **Phythia falls to describe jet multiplicities**
- **SHERPA (parton shower+ME) successfully describes multiplicities**

W→mn Charge Asymmetry
- **230 pb^{-1}**
- **MRST02 PDF**



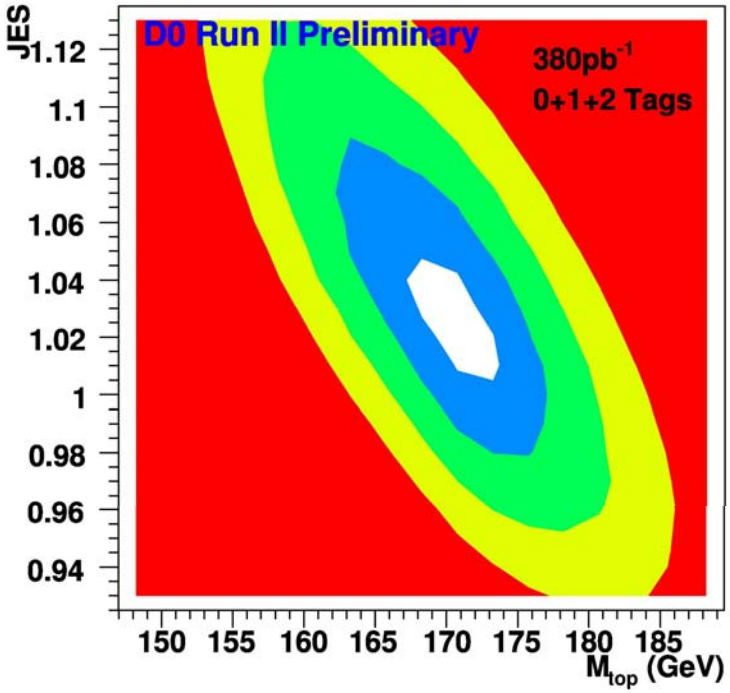
Top: Mass

Lepton + Jet(b-tag)

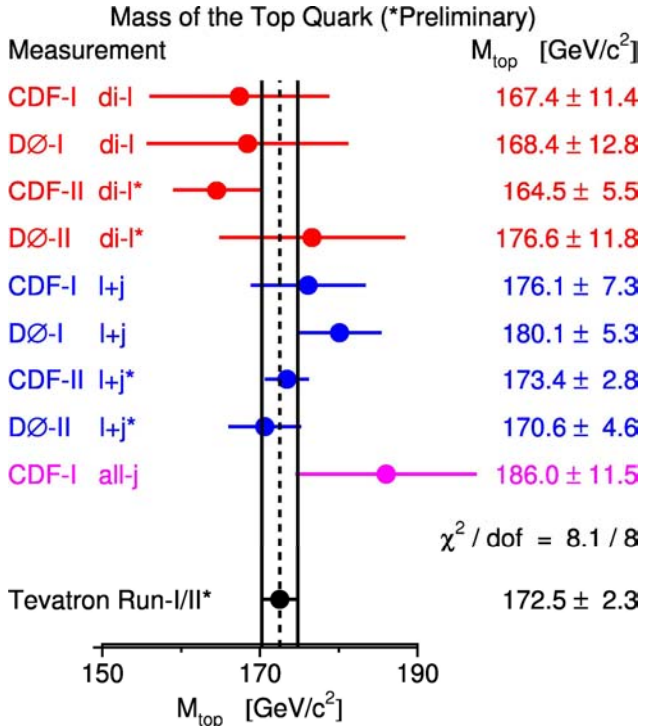


176.6+/-11.2 stat +/- 3.8 sys GeV

ME: Lepton + Jet(b-tag)

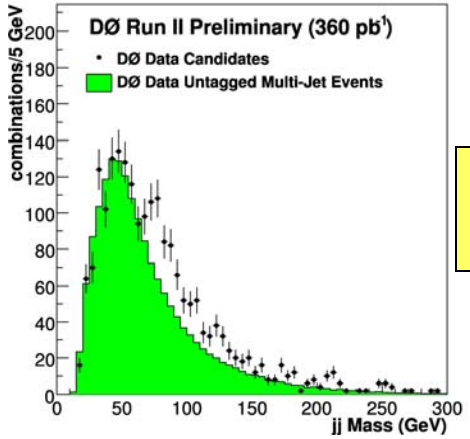


170.6 +4.0/-4.7 stat +/- 1.4 sys GeV



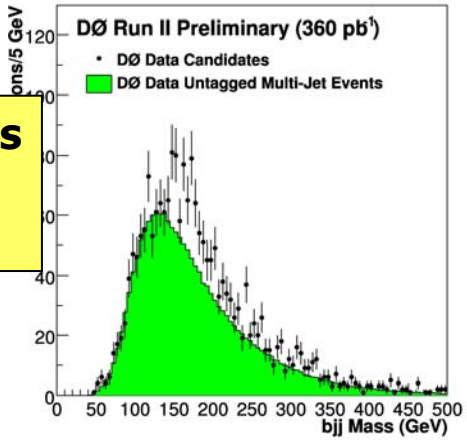
Top : Cross Sections

All jet cross-section
σ = 12.1+/-4.9+/-4.6 pb

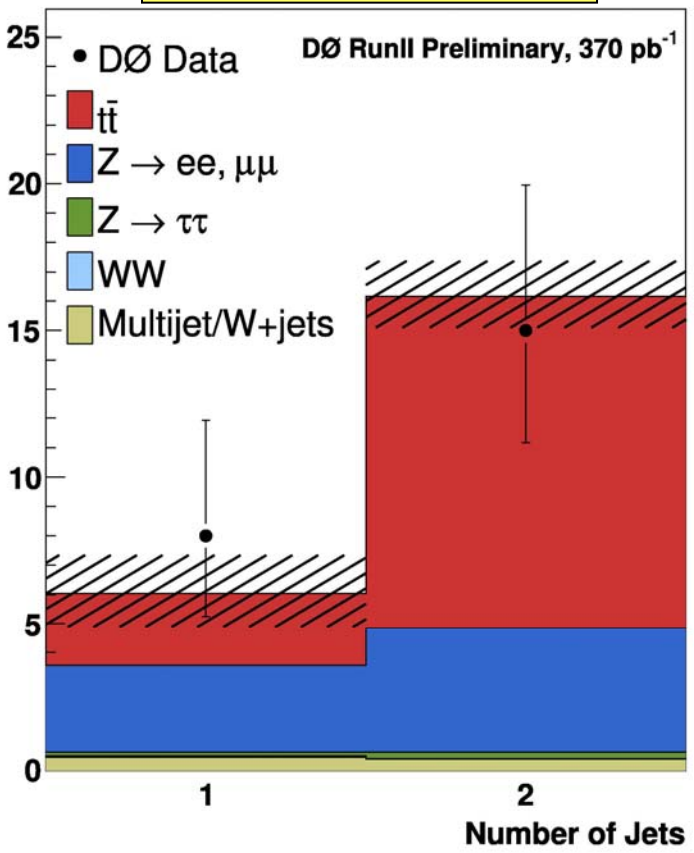


No b-tagged dijets

Three jet mass
•1 b-tag
•2 no b-tag



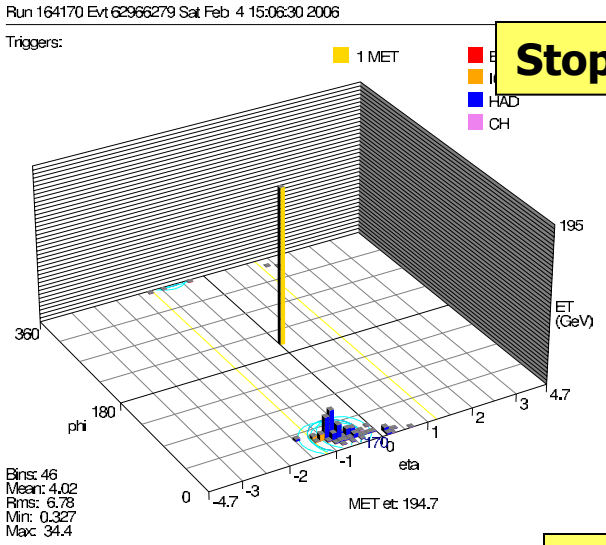
lepton+track+btag

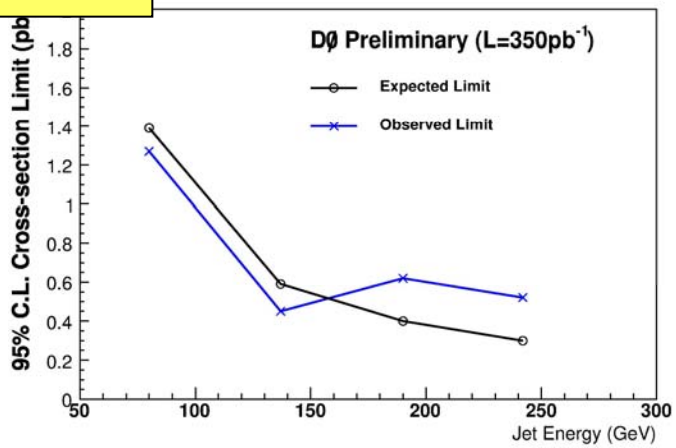


Lepton+track+btag & eμ
σ = 8.6 +1.9/-1.7(stat) +/-1.1(sys) +/-0.6 pb

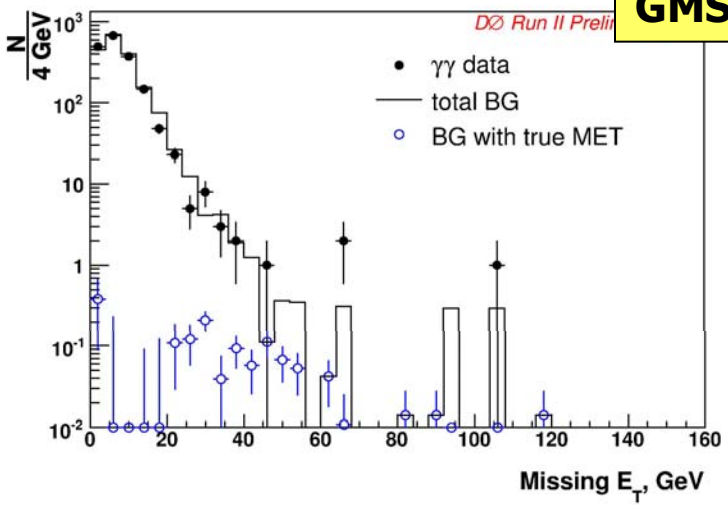
New Phenomena - SUSY

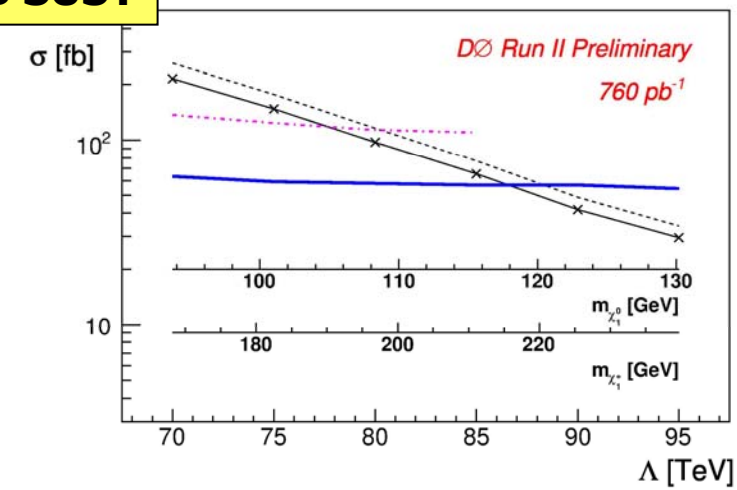
Stopped Gluinos





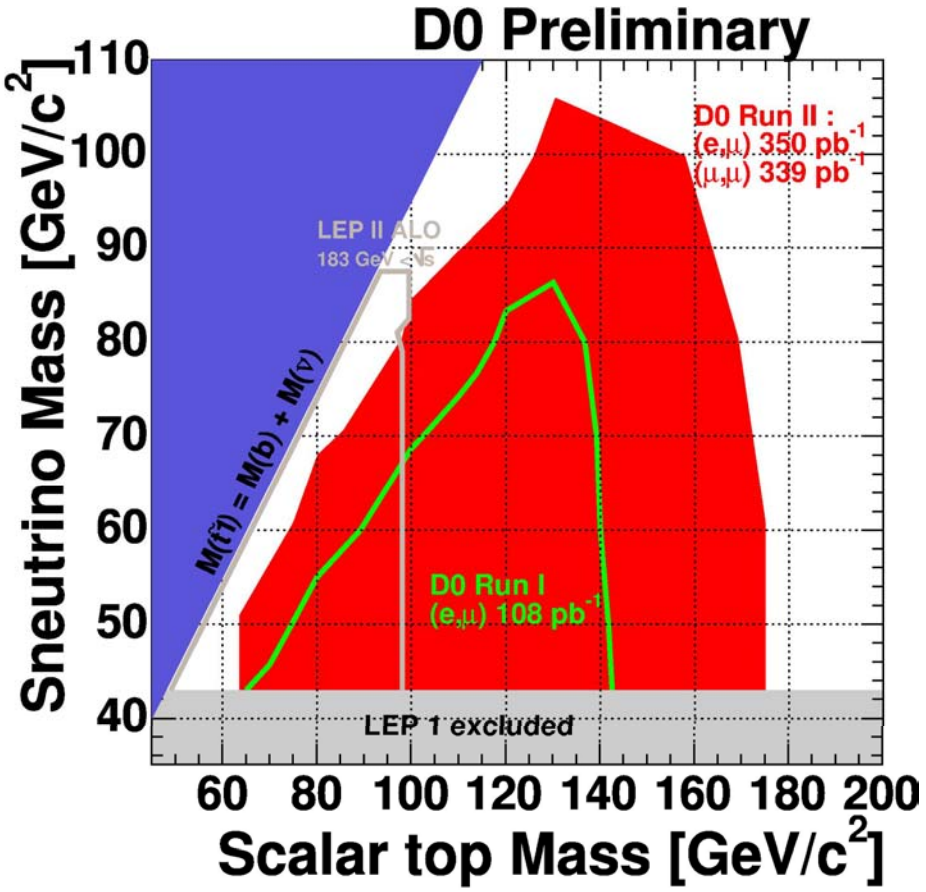
GMSB SUSY



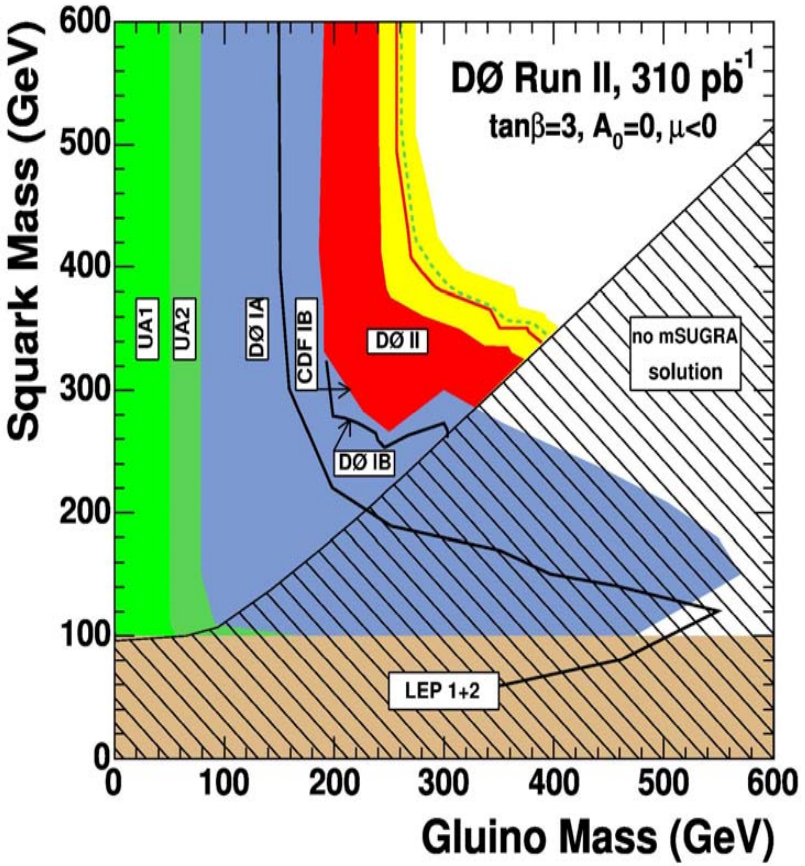


More SUSY

stop Search

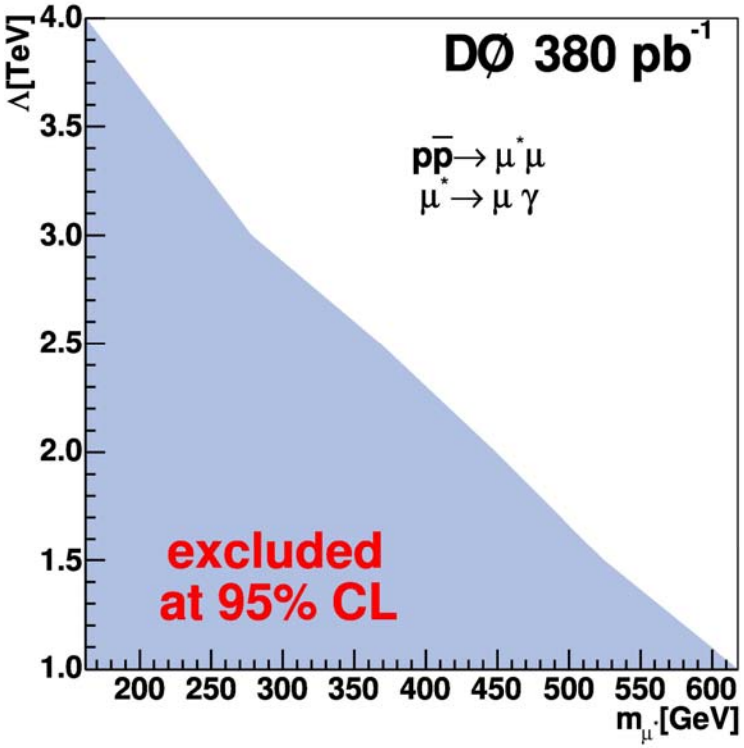


Squarks and Gluinos

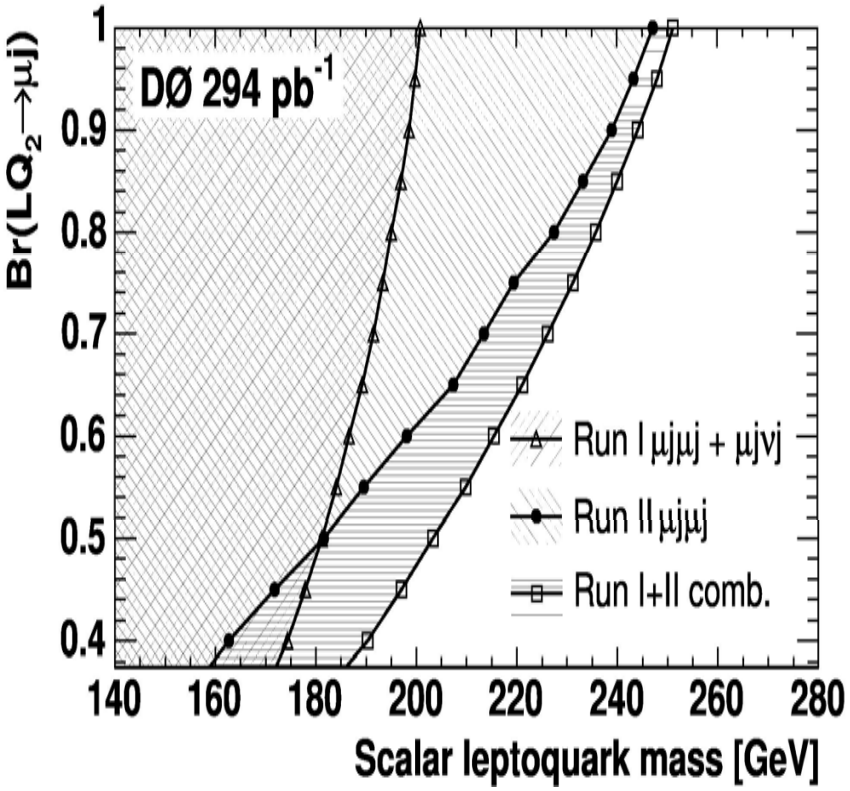


Two Exotics

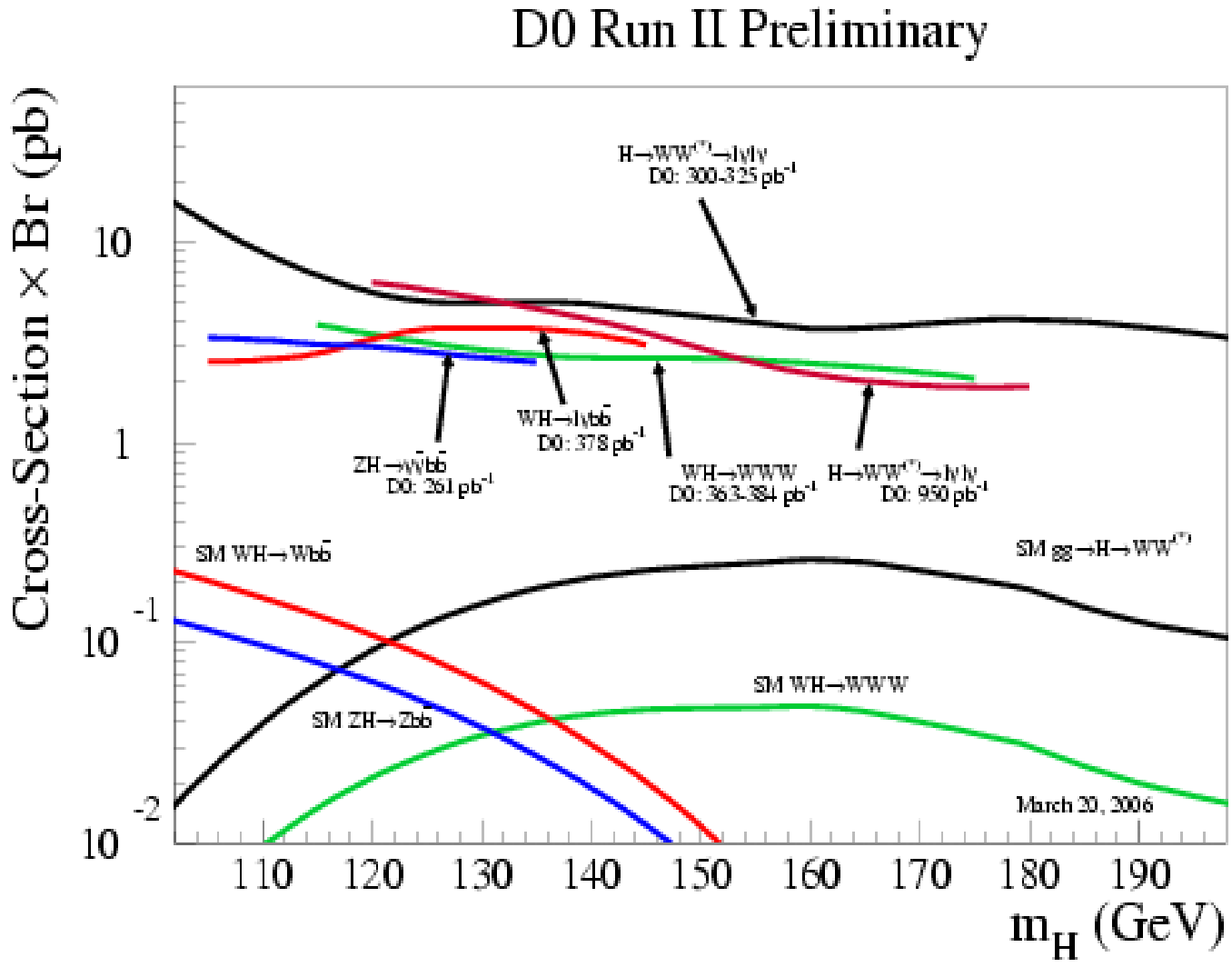
Excited Muons



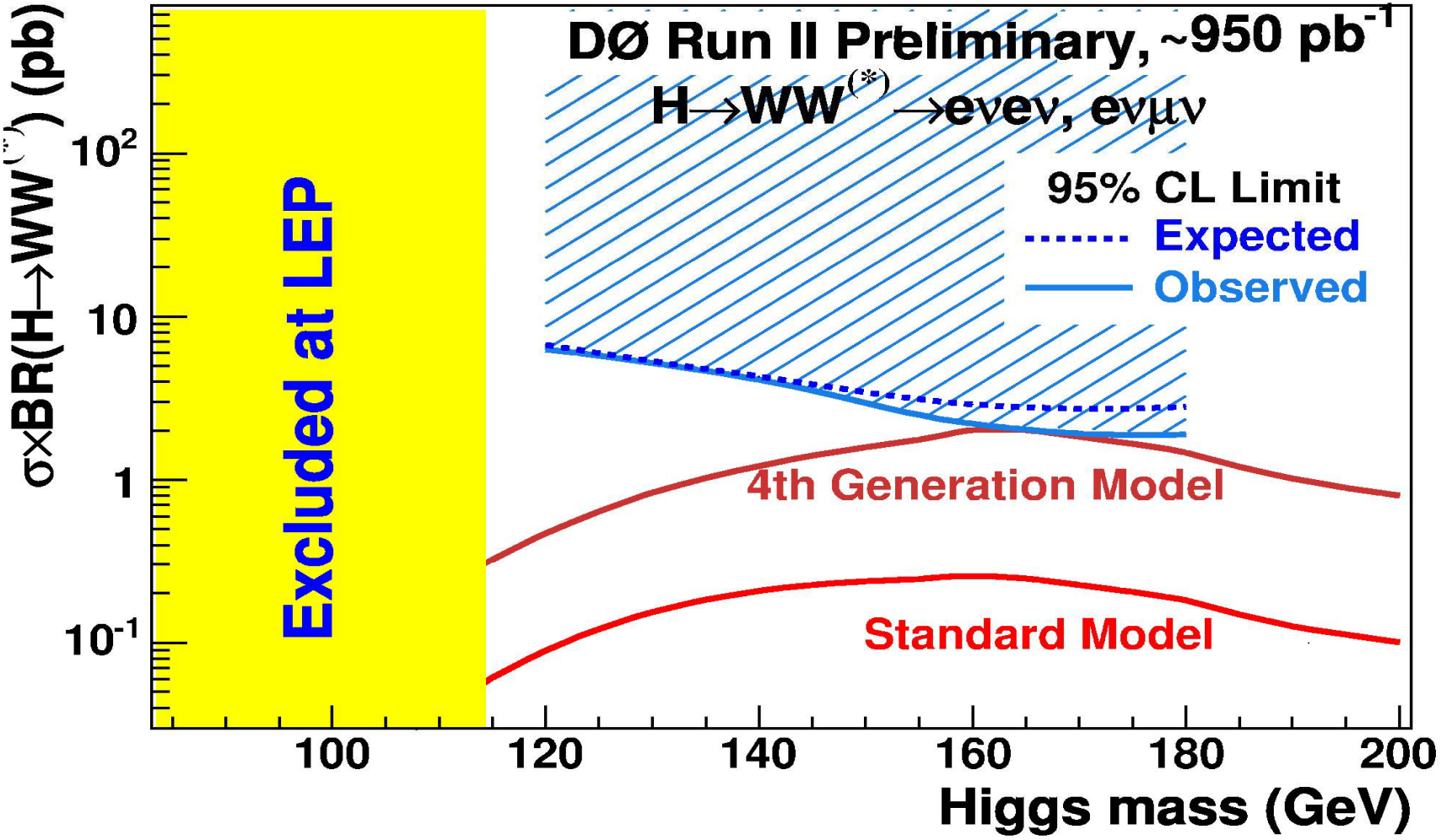
2nd Generation Leptoquark



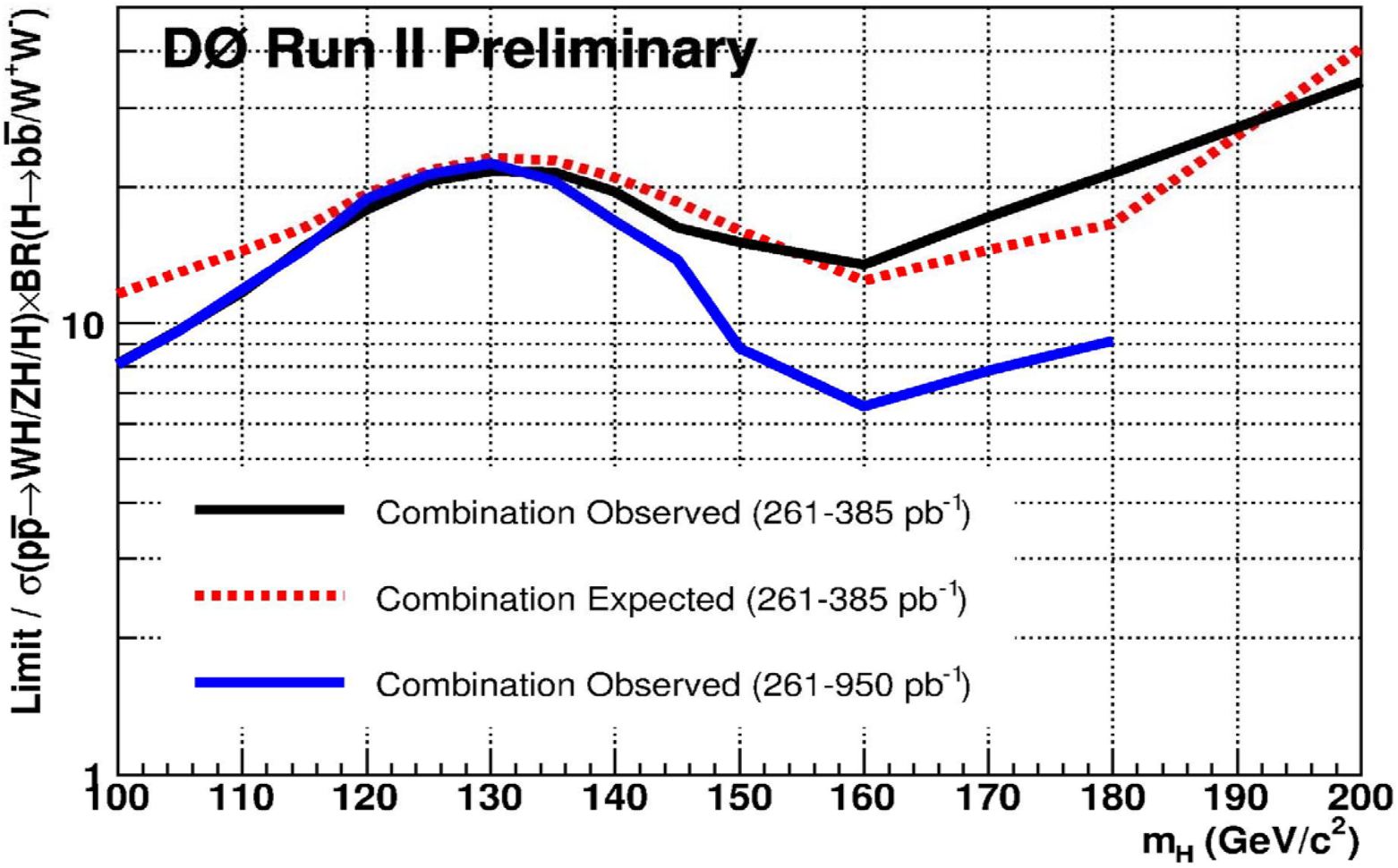
Compiled Higgs Searches



Higgs to WW


DØ Run II Preliminary, ~950 pb-1
H→WW(*)→eνeν, eνμν
95% CL Limit
Expected
Observed
Excluded at LEP
4th Generation Model
Standard Model
σ×BR(H→WW(*)) (pb)
10²
10
1
10⁻¹
100
120
140
160
180
200
Higgs mass (GeV)

Combined Higgs Searches



Conclusions

- Good stewards of your investment in DZero
- Efficiently collected Run IIa data
- All analyses maturing and incorporating entire data set → publishing with $1fb^{-1}$!
- An exciting future!